JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRANSPORT, VIETNAM

THE COMPREHENSIVE STUDY
ON THE SUSTAINABLE DEVELOPMENT OF TRANSPORT SYSTEM
IN VIETNAM
(VITRANSS 2)

North-South Expressway Master Plan
Final Report

May 2010

ALMEC CORPORATION
ORIENTAL CONSULTANTS CO. LTD.
NIPPON KOEI CO. LTD.

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Exchange Rate Used in the Report

USD 1 = JPY 110 = VND 17,000

(Average Rate in 2008)

PREFACE

In response to the request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS2) and entrusted the program to the Japan International cooperation Agency (JICA)

JICA dispatched a team to Vietnam between November 2007 and May 2010, which was headed by Mr. IWATA Shizuo of ALMEC Corporation and consisted of ALMEC Corporation, Oriental Consultants Co., Ltd., and Nippon Koei Co., Ltd.

In the cooperation with the Vietnamese Counterpart Team, the JICA Study Team conducted the study. It also held a series of discussions with the relevant officials of the Government of Vietnam. Upon returning to Japan, the Team duly finalized the study and delivered this report.

I hope that this report will contribute to the sustainable development of transport system and Vietnam and to the enhancement of friendly relations between the two countries.

Finally, I wish to express my sincere appreciation to the officials of the Government of Vietnam for their close cooperation.

May 2010

HIROYO SASAKI,
Vice President
Japan International Cooperation Agency

May 2010

HIROYO SASAKI
Vice President
Japan International Cooperation Agency
Tokyo

Subject: Letter of Transmittal

Dear Sir,

We are pleased to formally submit herewith the final report of the Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS2).

This report compiles the results of the study which was undertaken both in Vietnam and Japan from November 2007 to May 2010 by the Team comprising ALMEC Corporation, Oriental Consultants Co., Ltd., and Nippon Koei Co., Ltd.

We owe a lot to many people for the accomplishment of this report. First, we would like to express our sincere appreciation and deep gratitude to all those who extended their extensive assistance and cooperation to the Team, in particular the Ministry of Transport of Vietnam.

We also acknowledge the officials of your agency, the JICA Advisory Committee, and the Embassy of Japan in Vietnam for their support and valuable advice in the course of the Study.

We hope the report would contribute to the sustainable development of transport system and Vietnam.

Very truly yours,

IWATA Shizuo
Team Leader
The Comprehensive Study
on the Sustainable Development
of Transport System in Vietnam
(VITRANSS2)

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ABBREVIATIONS

ADB	Asian Development Bank
BOT	Build Operate Transfer
DD	Detailed design
DQIZ	Dung Quat Industrial Zone
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
EIRR	economic internal rates of return
ETC	Electronic Toll Collection
FIRR	financial internal rate of return
FS	feasibility study
GMS	Great Mekong. Sub-Region
GOV	Government of Vietnam
GRDP	gross regional domestic product
HCM	Ho Chi Minh
HCMC	Ho Chi Minh City
HLD	Ho Chi Minh–Long Thanh–Dau Giay Expressway
HSR	high-speed railway
IBRD	International Bank for Reconstruction and Development
IFI	International Finance Institution
ITS	Intelligent Transport System
IWT	inland waterway transportation
JH	Japan Public Highway Corporation
JICA	Japan International Cooperation Agency
LOS	Level of Service
LRT	Light Rail Transit
MOF	Ministry of Finance
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
NFEZ	Northern Focal Economic Zone
NH	national highway
NSEXY	North-South Expressway
NSHSR	North-South Highs-Speed Railway
O&M	operation and maintenance
ODA	official development assistance
PAP	project affected persons
PCU	passenger car units
PDO	Program Development Office
PMU	Project Management Unit
PPP	public-private partnership
RAP	Resettlement Action Plan
ROW	Right of way
SEA	Strategic Environment Assessment
SFEZ	Southern Focal Economic Zone
US	Unites States
USD	US Dollar
VEC	Vietnam Expressway Corporation
VGFM	Viability Gap Finding Mechanism
VITRANSS	The Study on the National Transport Development Strategy in the Socialist Republic of Vietnam
VITRANSS 2	The Comprehensive Study on the Sustainable Development of Transport System in Vietnam
VND	Vietnam dong
VOC	Vehicle operating cost
VRA	Vietnam Road Administration
WTO	World Trade Organization

MAIN TEXT

1 INTRODUCTION

This report has been prepared as part of the Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS 2) which aims to:

(i) Formulate a comprehensive, long-term transportation sector development strategy up to 2030;
(ii) Formulate a comprehensive medium-term transportation master plan up 2020;
(iii) Formulate a short-term investment program for the period 2011–2015;
(iv) Formulate a North-South Expressway Network master plan and conduct a feasibility study review for the two missing links around Ho Chi Minh City;
(v) Conduct preliminary planning for the north-south high-speed railway; and
(vi) Transfer technology to Vietnamese counterpart team in the course of the study.

Specifically, this report addresses the fourth objective above. Based on the review of existing information and conduct of a series of analyses, the prefeasibility study of the priority section(s) was cancelled because feasibility studies of all sections of the network have already been or are currently being undertaken by various agencies. In lieu of this activity, a review of the studies that were earlier conducted by the Government of Vietnam (GOV) on two missing links in the east and west of Ho Chi Minh City (HCMC) was undertaken to accelerate their implementation.

Following this introductory section, Chapter 2 of this report discusses the basic role and strategic importance of the North-South Expressway in Vietnam's national transport system. It stresses the need for high quality transport infrastructure to improve flow of passenger transport and distribution of goods especially along the national backbone in order to facilitate regional as well as national economic development.

Chapter 2 also presents the results of the review of the Expressway master plan which was prepared by the Ministry of Transport (MOT). Likewise, this chapter provides updates on the current progress in the preparation and implementation of the North-South Expressway Project.

The situational characteristics of the North-South Coastal Corridor, where the North-South Expressway is located, are discussed in Chapter 3. The chapter covers the corridor's spatial structure, natural conditions, socio-economic characteristics, supply of and demand for transport infrastructure services, and the need for transportation network connectivity to facilitate regional integration.

Chapter 4 summarizes the results of the review of expressway-related documents, and proposes modifications in the North-South Expressway Network Plan mainly from the engineering viewpoint. The review covers planning standards, route selections, interchanges, expressway facilities and structures, and linking roads.

Chapter 5 outlines the requirements for the Expressway's operation, maintenance and management while Chapter 6 discusses cost estimation, and the results of the economic and financial analyses and strategic environmental assessment. This chapter also discusses prioritization of project sections based on multi-criteria analysis.

Chapter 7 presents the proposed implementation schedule and strategies, as well as options to obtain funding for the full development of the Expressway. This chapter also enumerates the institutional and organizational issues relating to the development and implementation of the Expressway and recommends measures on how to move forward.

Chapters 8 and 9 discuss the review of the two missing links mentioned earlier. These are the Eastern and Western missing links of the North-South Expressway around Ho Chi Minh City. Finally, Chapter 10 provides the conclusion and recommendations of the report.

2 NORTH-SOUTH EXPRESSWAY IN THE NATIONAL TRANSPORT SYSTEM

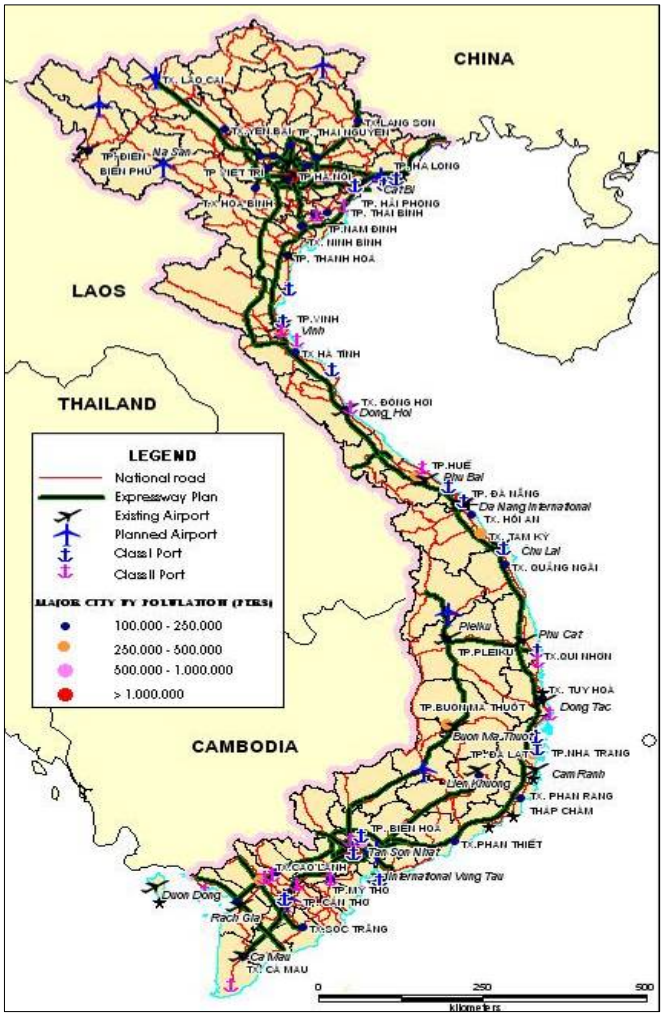
2.1 Review of MOT's Expressway Master Plan

1) Concept Plan

The latest expressway master plan, prepared by the MOT and approved by the Prime Minister under Decision No. 1734/QD-TTG dated 1 December 2008, includes a comprehensive network of 5,753 km of expressways (see Figure 2.1.1). VITRANSS 2 adopted this plan and used it as basis for formulating the expressway development strategy.

The MOT Expressway master plan includes two north–south expressways with a combined total length of 3,262 km. The North-South Expressway in the east has a length of 1,941 km while the one in the west is approximately 1,321 km. These expressways will have 1,096 km of four-lane sections (34%), 1,719 km of four- to six-lane sections (53%), 357 km of six-lane sections (11%), 100 km of six- to eight-lane sections (3%), and 40 km of eight-lane sections (1%). The total investment cost of these expressways is estimated at VND 320 trillion (USD19 billion). See Table 2.1.1.

Figure 2.1.1 MOT Expressway Plan



Source: MOT Master Plan (No.7056/TTr-BGTVT dated 5 November 2007)

Table 2.1.1 List of Projects in the MOT Expressway Master Plan

No.		Section	Length (km)	No. of Lanes	Cost (VND bil.)
North–South Expressway in the East	1	Cau Gie–Ninh Binh	50	6	9,300
	2	Ninh Binh–Thanh Hoa	75	6	12,380
	3	Thanh Hoa–Vinh	140	6	22,120
	4	Vinh–Ha Tinh	20	4-6	2,580
	5	Ha Tinh–Quang Tri	277	4	21,610
	6	Quang Tri–Da Nang	178	4	18,160
	7	Da Nang–Quang Ngai	131	4	17,820
	8	Quang Ngai–Quy Nhon	150	4	23,700
	9	Quy Nhon–Nha Trang	240	4	24,960
	10	Nha Trang–Dau Giay	378	4□6	55,940
	11	HCMC–Long Thanh–Dau Giay	55	6□8	18,880
	12	Long Thanh–Nhon Trach–Ben Luc	45	6□8	12,340
	13	HCMC–Trung Luong	40	8	13,200
	14	Trung Luong–My Thuan–Can Tho	92	6	26,250
North-South Expressway in the West	15	Doan Hung–Hoa Lac–Pho Chau	457	4□6	53,930
	16	Ngoc Hoi–Chon Thanh–Rach Gia	864	4□6	96,770
Northern Vietnam	17	Lang Son–Bac Giang–Bac Ninh	130	4□6	12,220
	18	Hanoi–Hai Phong	105	4□6	16,800
	19	Hanoi–Lao Cai	264	4□6	15,580
	20	Hanoi–Thai Nguyen	62	4□6	4,220
	21	Thai Nguyen–Cho Moi	28	4□6	2,940
	22	Lang–Hoa Lac	30	6	7,650
	23	Hoa Lac–Hoa Binh	26	4□6	2,550
	24	Bac Ninh–Ha Long	136	6	19,040
	25	Ha Long–Mong Cai	128	4□6	13,820
	26	Ninh Binh–Hai Phong–Quang Ninh	160	4	13,760
Central Vietnam	27	Hong Linh–Huong Son	34	4	2,450
	28	Cam Lo–Lao Bao	70	4	4,900
	29	Quy Nhon–Pleiku	160	4	12,000
Southern Vietnam	30	Dau Giay–Da Lat	189	4	19,280
	31	Bien Hoa–Vung Tau	76	6	12,160
	32	HCMC–Thu Dau Mot–Chon Thanh	69	6-8	20,010
	33	Can Tho–Ca Mau	150	4	24,750
	34	HCMC–Moc Bai	55	4□6	7,480
	35	Soc Trang–Can Tho–Chau Doc	200	4	24,200
	36	Ha Tien–Rach Gia–Bac Lieu	225	4	27,230
Ring Road System in Hanoi	37	Ring road No 3	56	4□6	17,990
	38	Ring road No 4	125	6□8	34,500
Ring Road System in HCMC	39	Ring road No 3	83	6□8	20,750
Total			5,753		766,220

Source: MOT Master Plan (No.7056/TTr-BGTVT dated 5 November 2007)

Note: This table does not include the following: Bac Ninh–Phap Van section (40 km), Phap Van–Cau Gie section (30 km), Noi Bai–Bac Ninh section (30 km), and Lien Khuong–Da Lat section (20 km).

2.2 Defined North-South Expressway Network in VITRANSS 2

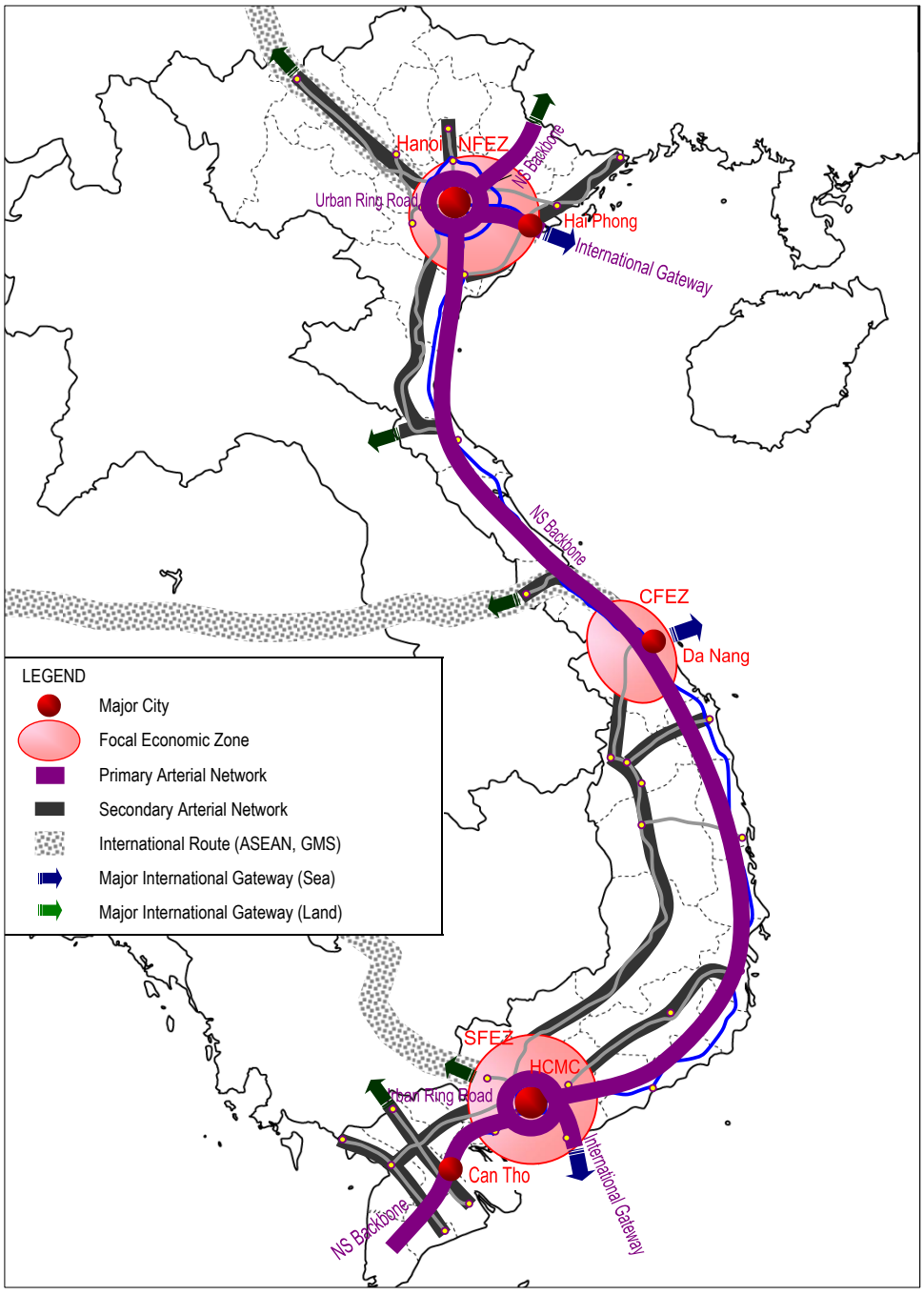
1) VITRANSS 2 Expressway Plan (Do-maximum Network)

The Expressway master plan covers a comprehensive network. Related studies are currently undertaken to realize the plan. The VITRANSS 2 Study Team proposes to incorporate the following in order to improve the master plan:

(1) Classification of Expressway Network

In the view of the function of each expressway in the entire network and the conceptual network development plan shown in Figure 2.2.1, expressways can be classified into primary and secondary arterial networks.

Figure 2.2.1 Conceptual Network Development Plan

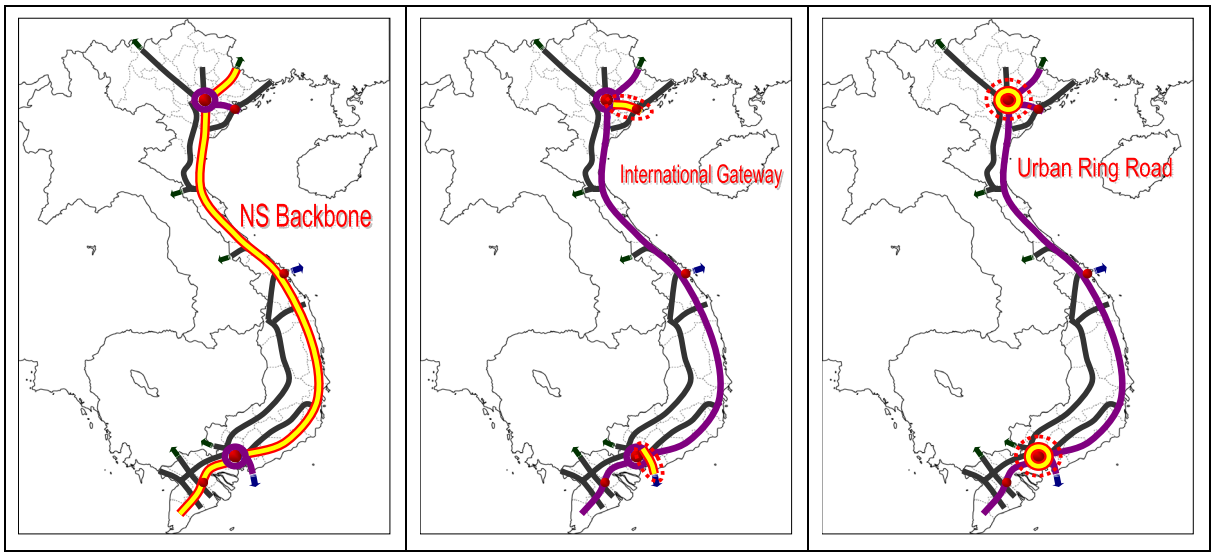


Source: VITRANSS 2 Study Team

(a) Primary Arterial Network

The Primary Arterial Network, comprising the north–south backbone (coastal), international gateways, and urban ring roads shown in Figure 2.2.2, connects the strategic ports of the country. Developing and strengthening this network is important because it will facilitate efficient commercial and freight movements and promote regional development.

Figure 2.2.2 Primary Arterial Network



Source: VITRANSS 2 Study Team

(b) Secondary Arterial Network

The remaining expressways are classified into Secondary Arterial Network. This network is also indispensable in ensuring the country's balanced development.

The primary and secondary arterial networks are shown in Figure 2.2.3 and the list of VITRANSS 2 Expressway projects is presented in Table 2.2.1.

(2) Three Additional Supplementary Expressway Segments

The following expressways are proposed in addition to those included in the MOT Expressway master plan:

(a) Danang–Ngoc Hoi, 250 km

Expressways should form a network. Based on the current plan, Ngoc Hoi is a dead end. Instead of stopping in this area, it is proposed that an expressway connecting Danang and Ngoc Hoi be developed. This segment will provide an alternative to the coastal route and will therefore contribute to the socio-economic development of the area. In addition, the Pakxe (Lao PDR)–Ngoc Hoi–Danang is one of the east–west economic corridors of the Greater Mekong Sub-region (GMS). This segment will promote cross-border economy and contribute to the development of the entire GMS.

(b) Quang Ngai–Dak To, 170 km

The Quang Ngai–Dak To Expressway is essential in connecting Lao PDR and the Dung Quat Industrial Zone (DQIZ) where an oil refinery facility has already started production on 22 February 2009. DQIZ needs a strong transportation infrastructure in order to distribute its products not only in Vietnam but outside as well. Trucks carrying goods produced in

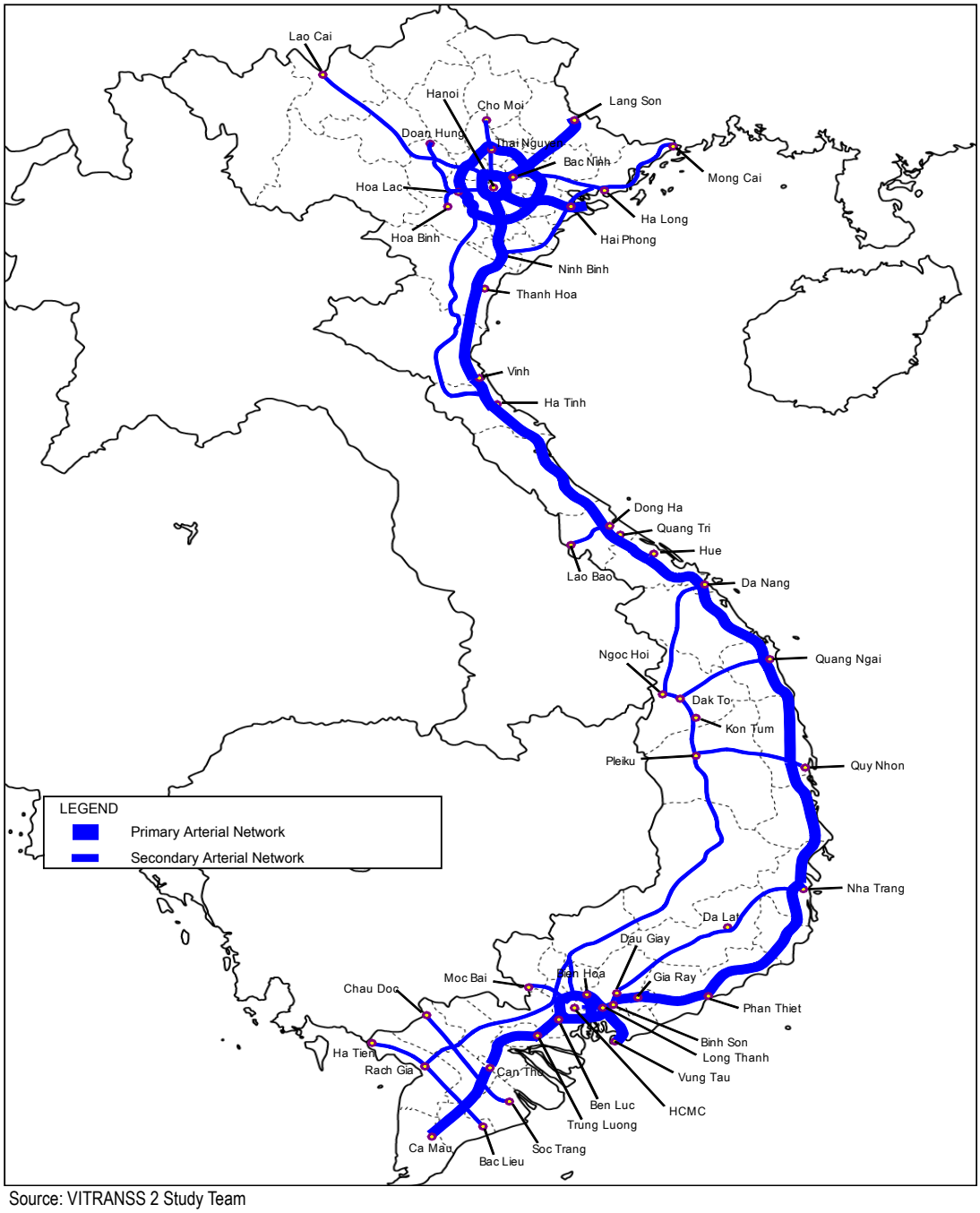
Lao PDR and to be exported through the Danang port can carry backhaul freight such as oil and other products from the DQIZ.

Moreover, the distance between Danang and Quy Nhon is 300 km. This seems too long not to have an east-west expressway.

(c) Nha Trang–Da Lat, 80 km

Expressways should form a network; therefore Da Lat should not be a dead-end. This segment will be an alternative to the coastal route. It will promote regional industries thereby contributing to the area's overall socio-economic development. Moreover, both Nha Trang and Da Lat are famous tourist destinations in Vietnam. Reaching these cities within an hour will definitely contribute to the development of tourism in the area.

Figure 2.2.3 VITRANSS 2 Expressway Network (Do-maximum Network)



Source: VITRANSS 2 Study Team

Table 2.2.1 List of VITRANSS 2 Expressway Projects

No.		Section	Length (km)	Cost (USD mil.)	No. of Lanes
Primary Arterial Network					
1. North-South Backbone					
1	CH07	Lang Son–Bac Giang–Bac Ninh	130	1,176.2	4
2	-	Phap Van–Cau Gie	30	Existing	4
3	CH01	Cau Gie–Ninh Binh	50	452.4	4
4	H01	Ninh Binh–Thanh Hoa	75	827.6	6
5	H02	Thanh Hoa–Vinh	140	2,128.0	6
6	H03	Vinh–Ha Tinh	20	201.5	4
7	H04	Ha Tinh–Quang Tri	277	2,641.2	4
8	H05	Quang Tri–Hue	73	711.9	4
9	H06	Hue–Da Nang	105	1,778.0	4
10	CH02	Da Nang–Quang Ngai	131	1,048.2	4
11	H07	Quang Ngai–Quy Nhon	150	1,787.8	4
12	H08	Quy Nhon–Nha Trang	240	3,390.1	4
13	H09	Nha Trang–Phan Thiet	280	2,890.2	4
14	CH03	Phan Thiet–Dau Giay	100	1,003.8	4
15	CH04	HCMC–Long Thanh–Dau Giay	55	1,110.8	6
16	H10	Long Thanh–Nhon Trach–Ben Luc	45	738.6	6
17	CH05	HCMC–Trung Luong	40	776.5	6
18	CH06	Trung Luong–My Thuan–Can Tho	92	1,510.0	6
19	H26	Can Tho–Ca Mau	150	1,755.7	4
2. International Gateway					
20	CH08	Ha Noi–Hai Phong	105	1,441.2	6
21	H21	Bien Hoa–Vung Tau	76	696.5	6
3. Urban Ring Road					
22	H30	Ring Road No.4 in Ha Noi	90	1,350.5	6
23	H31	Ring Road No.5 in Ha Noi	320	2,583.2	6
24	H32	Ring Road No.3 in HCMC	83	1,226.9	6
Secondary Arterial Network					
25	CH09	Ha Noi–Lao Cai	264	1,218.7	4
26	CH10	Ha Noi–Thai Nguyen	62	248.2	4
27	CH11	Lang–Hoa Lac	30	450.0	6
28	H11	Doan Hung–Hoa Lac–Pho Chau	457	4,813.1	4
29	H12	Ngoc Hoi–Chon Thanh–Rach Gia	864	7,974.4	4
30	H13	Thai Nguyen–Cho Moi	28	256.9	4
31	H14	Hoa Lac–Hoa Binh	26	214.0	6
32	H15	Bac Ninh–Ha Long	136	1,618.8	6
33	CH12	Ha Long–Mong Cai	128	1,254.7	4
34	H16	Ninh Binh–Hai Phong–Quang Ninh	160	1,189.4	4
35	H17	Hong Linh–Huong Son	34	302.0	4
36	H18	Cam Lo–Lao Bao	70	699.1	4
37	H19	Quy Nhon–Pleiku	160	1,615.1	4
38	H20	Dau Giay–Da Lat	189	1,871.0	4
39	H22	HCMC–Thu Dau Mot–Chon Thanh	69	996.3	6
40	H23	HCMC–Moc Bai	55	410.5	4
41	H24	Soc Trang–Can Tho–Chau Doc	200	1,439.6	4
42	H25	Ha Tien–Rach Gia–Bac Lieu	225	1,619.5	4
43	H27	Quang Ngai–Dak To	170	2,073.6	4
44	H28	Nha Trang–Da Lat	80	1,062.5	4
45	H29	Binh Son–Gia Ray	30	249.7	4
46	H29	Da Nang–Ngoc Hoi	250	3,094.2	4

Source: VITRANSS 2 Study Team

2.3 Basic Role and Strategic Importance of the North-South Expressway

1) The Role of the North-South Expressway in the Overall Transportation System

The need for high-quality transportation infrastructure to improve access and mobility, especially along the national backbone, has long been a priority policy in the national land and transportation development plan of Vietnam. The plan includes the development of the North-South Expressway and a high-speed railway, and improvement of air transportation, and coastal shipping.

Despite the extensive investments in roads during the last decade, the demand–supply gap in and around major urban areas and along main transportation corridors has significantly widened because of the sharp increase in overall road traffic volume that resulted from high economic growth in recent years. In addition, significant changes have taken place in the nature of traffic. While the use of motorcycles remains substantial, transportation of passengers and goods through cars and heavy trucks have substantially increased. These changes are taking place in any conventional national roads which are mostly substandard and associated with unplanned roadside developments. Many sections of the main roads have become degraded and have not been adequately maintained. As s result, the flow of passenger transport and distribution of goods have been seriously hampered. The increasing mix of different types of traffic has also adversely affected smooth inter-city traffic. Safety and comfort have also been compromised.

These problems can be alleviated by widening the main roads. However, this option seems difficult to implement because it requires massive resettlement and entails huge investment requirements. Segregating long-distance heavy traffic from local traffic is also hard to implement because of the many at-grade intersections.

Because of the above, the need for expressways has been increasingly felt in Vietnam from the economic, social, and environmental viewpoints. Expressways in Vietnam are envisioned to:

(a) **Segregate Long-distance Traffic from Local Traffic:** Urbanization in Vietnam is expected to further progress long into the future. It is also expected that industrial development will intensify and become extensive along main roads. While existing roads require improvement, the development of expressways to segregate non-local traffic from long-distance traffic would be necessary to respond to the changing context. The use of motorcycles is significantly high in Vietnam. It is necessary to consider this mode in the use of expressways.

(b) **Facilitate the Provision of Competitive Transportation Services to Ensure Efficiency, Safety, and Amenity:** Vietnam is and will be a trade-oriented economy that requires efficient and effective transportation services. Expressways offer a practical and realistic solution because they reduce transportation costs and travel time along main corridors and at gateways. At the same time, Vietnam intends to promote both international and domestic tourism. Safe and comfortable travel via road between home cities and tourism destinations can be provided by expressways.

(c) **Serve as Strategic Means to Achieve Regional Development:** The potential impact of expressway development on regional development must be tapped to the maximum possible extent and must be weighed when the routes are selected. Expressway development should be integrated with urban, industrial, tourism and other

developments. Adequate measures to promote local economic development through expressway development should also be worked out.

(d) **Serve as Core Transportation Corridors Integrating Key Transportation Modes:** The provision of high-quality and efficient transportation services has been difficult because of the weak inter-modal connectivity in Vietnam's transportation system. As existing congested and substandard roads are unable to function efficiently, expressways can and must fulfill the role of roads. For this reason, the current expressway network plan needs to be further elaborated to take into account the following:

(i) Guarantee of connectivity among major cities, provincial capitals, and growth centers including major industrial zones, gateway ports and airports. All of these must be accessed by expressways within a reasonable period of time;

(ii) Realization of effective network configuration with national and major provincial roads, as well as urban roads; and

(iii) Provision of the desired quality of passenger and freight transportation services by strengthening inter-modal facilities, logistics, and road user service facilities, as well as introducing information technology applications.

2) Strategic Importance and Current Progress of the North-South Expressway Project

While the contributions of the North-South Expressway to the national transport network are substantial, its development entails huge investment requirements. Therefore, this project should be evaluated properly and strategically.

Major airports and seaports developments need to introduce perspectives of international transport. While enhancing the capacity of airports and seaports to deal with increasing international transport is an urgent task, connectivity between major cities and ports needs to be looked into to facilitate efficient passenger and freight traffic movement (which is the main role of Gateway Corridors). A good network of support industries to supply materials to the manufacturing industry is also necessary.

The quality of transport service for local to inter-city level and accessibility to long distance transport service also need to be reinforced to promote regional development and reduce poverty.

Some sections of the North-South Expressway have already been committed for development or are already under construction. The construction of the Expressway is expected to start in three locations, namely Hanoi, Danang and HCMC. In the northern section, Hanoi–Cau Gie was already constructed and Cau Gie–Ninh Binh section (CH01) is under construction. Based on the multi-criteria analysis (see Chapter 6), the sections from Ninh Binh to Ha Tinh (H01, H02, H03) should be developed as priority sections in the next phase. In the central section, Danang–Quang Ngai section (CH02) has been committed already. Hue–Danang (H06) and then Quang Tri–Hue section (H05) can be considered in the next phase. In the southern section, HCMC - Logn Thanh–Dau Giay section (CH04) has been already committed, Phan Thiet–Dau Giay section (CH03) is expected to be developed in the early phase and Nha Trang–Phan Thiet section (H09) should be subsequently developed. Ha Tinh–Quang Tri section (H04) and Quang Ngai–Quy Nhon section (H07) should be the last sections to be developed to complete the entire expressway.

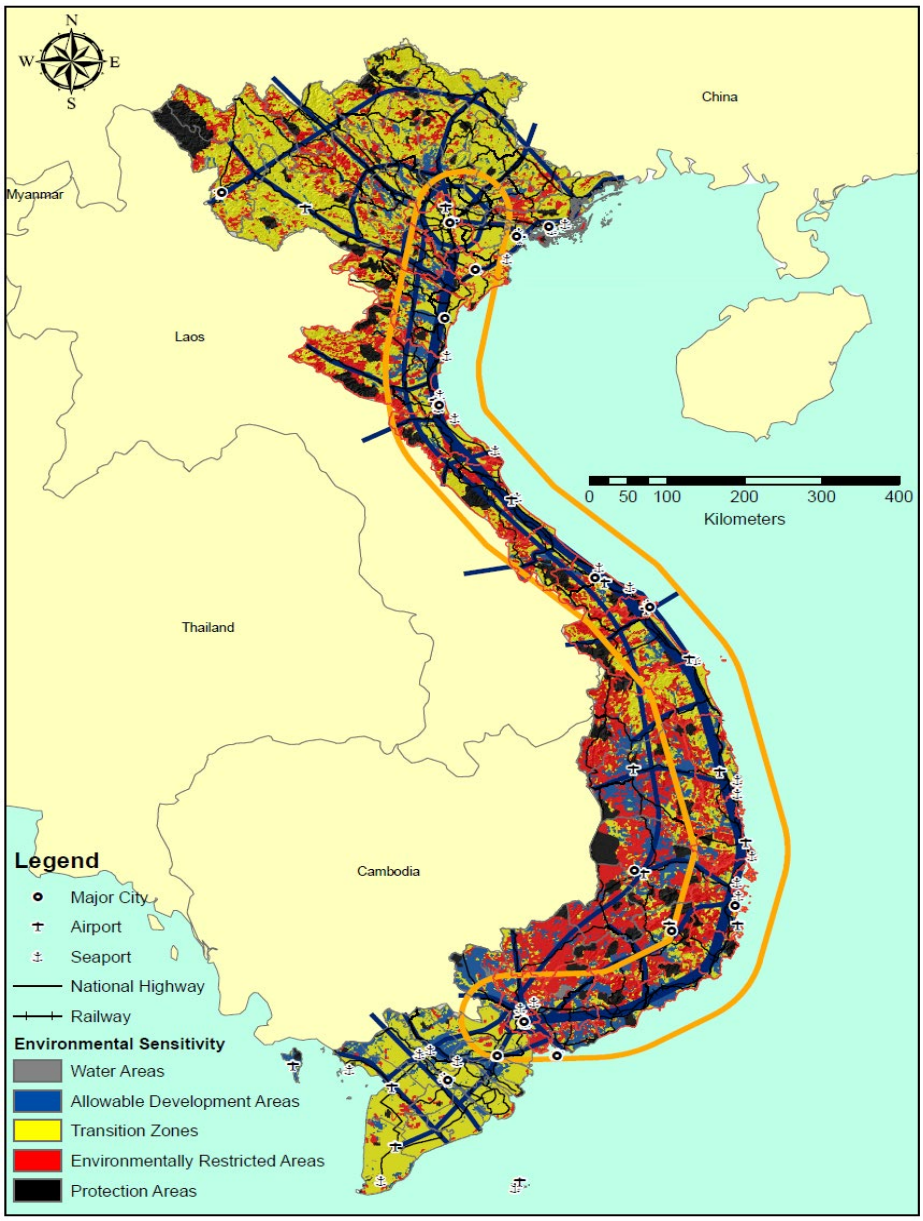
3 SITUATIONAL CHARACTERISTICS OF THE NORTH-SOUTH COASTAL CORRIDOR

3.1 Spatial Structure

1) General Characteristics

The North-South Coastal Corridor is the most important transportation backbone of Vietnam connecting its capital city, Hanoi, and the largest business/commercial center, HCMC, with a number of small- to medium-sized cities in between (see Figure 3.1.1). This corridor is served not only by road networks but by rail, air and shipping as well. Located along the country's coastline, the corridor generally passes through narrow strip of flat lowland with some steep sections particularly around the Hai Van Pass located in the midpoint of the corridor. The corridor involves 23 provinces along the National Highway 1 (NH1) from Hanoi to HCMC with a total length of around 1,790 km.

Figure 3.1.1 Location of the North-South Coastal Corridor

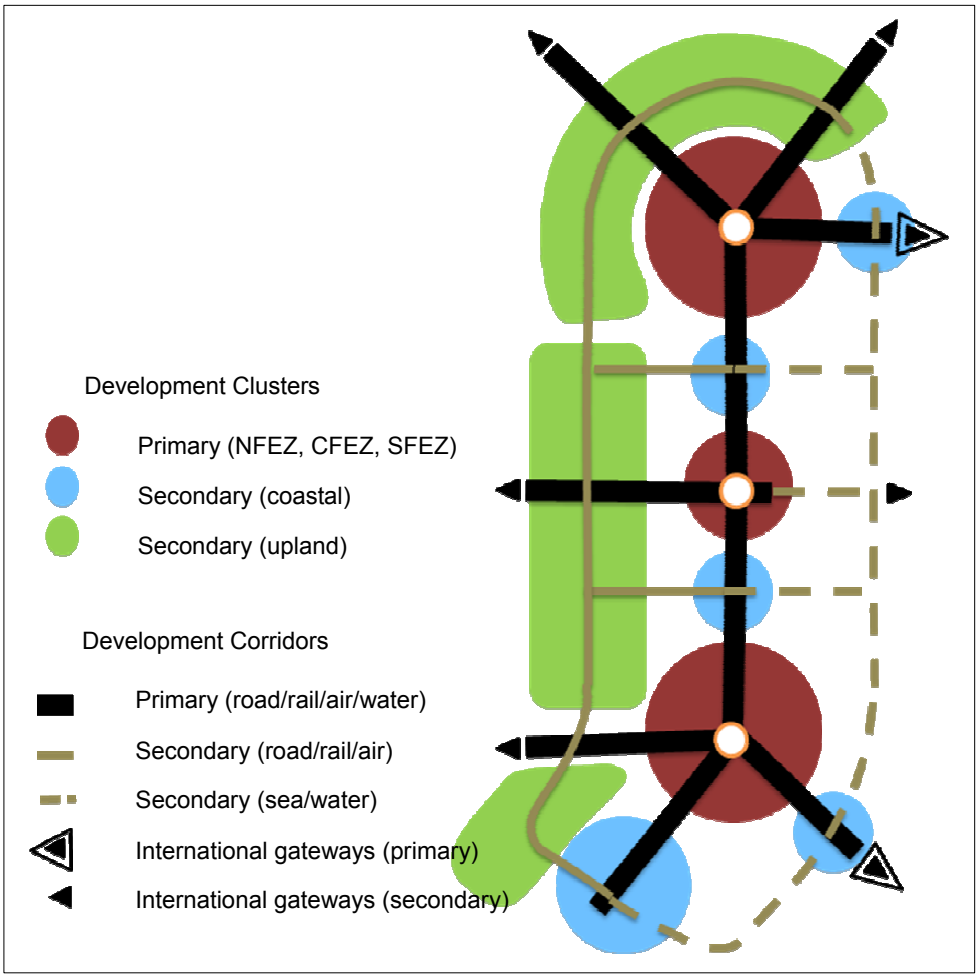


Source: VITRANSS 2 Study Team

2) Overall Spatial Structure

While transportation follows the pattern of economic development, it also provides its contour and spatial distribution. On a macro-level, the transportation system will support and re-enforce the growth of three focal economic zones (schematically shown in Figure 3.1.2).

Figure 3.1.2 National Physical Framework



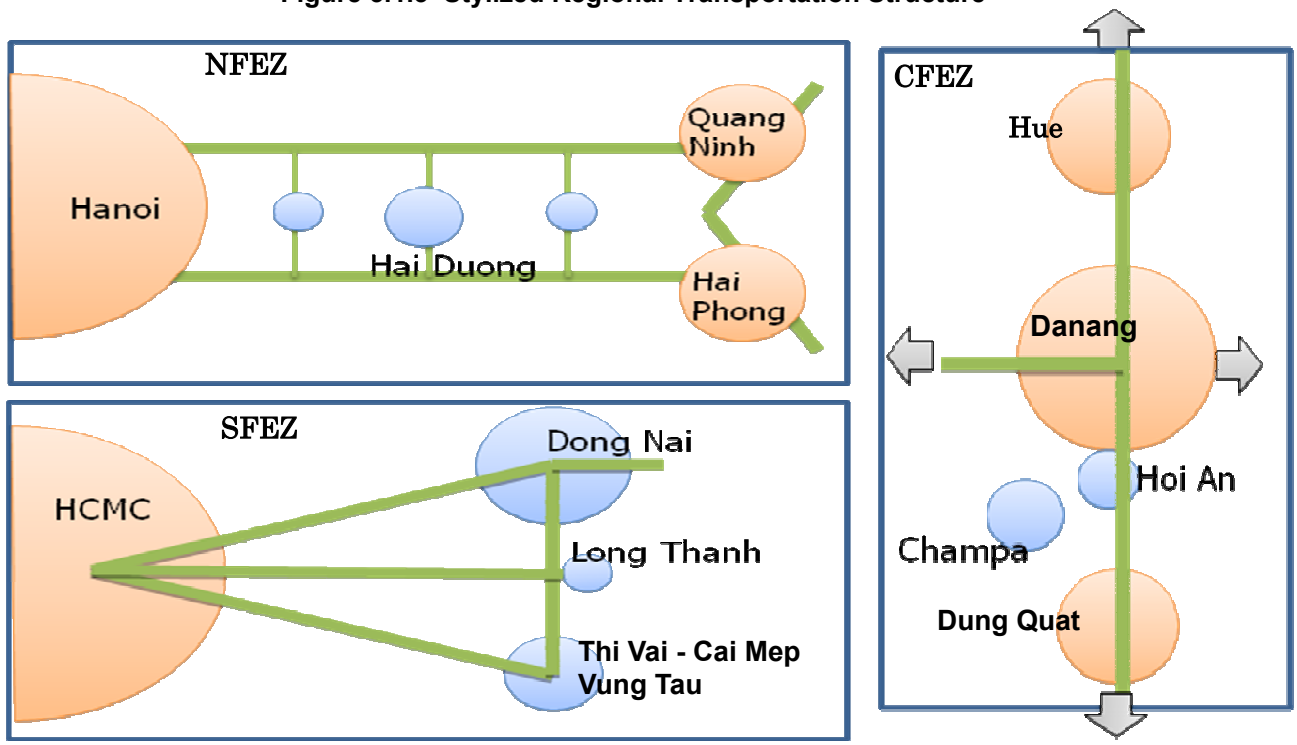
Source: VITRANSS 2 Study Team

The three (3) urban development clusters will be at the top of the hierarchy of human settlements to be supported and linked by high-capacity strategic network of expressways, express rail, coastal shipping and air transportation, while at the same time functioning as international gateways. The North-South Expressway passes through the North-South Coastal Corridor which links these urban clusters.

3) Impact on Regional Development

At the next level, each of the above-mentioned urban clusters will be the nucleus of development for their respective hinterlands, i.e., the adjoining provinces. Therefore, these clusters must be provided with the corresponding second-level transportation infrastructure consisting of national and inter-provincial roads, bus and possibly regional rail services and to some extent by air and inland waterway transportation. The North-South Expressway will function as an axis to promote regional development around the urban centers. Figure 3.1.3 depicts the conceptual regional transportation structures.

Figure 3.1.3 Stylized Regional Transportation Structure



Source: VITRANSS 2 Study Team

3.2 Natural Conditions

1) General Characteristics

Environmentally, only a part of the corridor is classified as sensitive, particularly in areas that include the Ba Na Nui Chua Nature Reserve (near Hai Van Pass) and Nui Chua Thanh Hai National Park (Ninh Thuan Province). There are also many sections with natural forest or steep slope that need development restriction, particularly in the south. In addition, typhoons often hit the north and central sections of the corridor which sometimes cause serious damage to the transport infrastructure.

2) Geologic Stratum

The North-South Expressway route is mostly located in young geologic stratum of Quaternary period and soft soil layers. The future route can be divided as follows in order to primarily assess its topographical conditions:

(1) Ninh Binh–South of Thanh Hoa

The route will mainly pass soft ground, ten meters thick. Quaternary geologic stratum could be seen including:

(a) Pre- Quaternary soil layers in this section include:

(i) Nam Pia Formation D_1 np: consist of two (2) geologic characteristics:

- I: consist of gravel mixed with marlaceous shale and limestone, in the South of Thanh Hoa Province; 450 m thick; and
- II: consist of thin-bedded limestone with colors of black grey and white grey; 160–70 m thick; in the South of Thanh Hoa Province;

(ii) Co Noi Formation T_1 cn: quite large distribution in the route section. Geotechnical cross section includes:

- I: consist of sandstone, Tuf clay shale, limestone, Tuf sandstone with color of black grey, green grey; 650 m thick; and
- II: consist of argillaceous limestone, siltstone, and thin layers of clay marl, marly lime; 80–120 m thick;

(iii) Dong Giao Formation T_2adg: distributed over Ninh Binh and Thanh Hoa Province and divided into 23 sub-formations:

- Lower sub-formation: limestone with colors of grey, green grey, dark grey; clearly layered and inserted with some thin-bedded clay marl, marly lime and calcareous sandstone; 320–400 m thick; and
- Upper sub-formation: light color limestone in shape of block or thick sub-formation moved up, most of the upper part is consist of small-grained limestone and thin layer of marly lime; 600–900 m thick;

(b) Vinh Phuc Formation ($amQ_{III}vp$): consist of black clay bearing peat, yellow spotted white grey clay; 23.50 m thick.

(c) Hai Hung Formation (QIV^{1-2} hh): consist of brown grey clay mixed with fine sand, small grains; 22.0 m thick.

(d) Thai Binh Formation (QIV^{3} tb): consist of clay mixed with yellow sand, with shells, small-grained sand, medium-grained sand, black grey clay, peat, 30.0 m thick.

(2) South of Thanh Hoa–Nghe An–Quang Binh

The route will pass mainly on soft ground with average thickness of <10.0 m, mixed with coastal sand strips, and will pass as well pre-Quaternary deposits in some places.

(a) Dong Trau Formation (T_2adt): consist of sandstone, siltstone, clay shale; distributed in Quang Trach, Quang Binh; 900–1,000 m thick;

(b) Dong Do Formation (T_3n-rdd): consist of gravel, quartz sandstone, siltstone, duns; mainly distributed in the South of Thanh Hoa province, scattered in districts of Dien Chau, Nghi Loc; >700.0 m thick.

(c) Phieu Booc Magma Complex, Nui Chua complex, scattered in Dien Chau (Nghe An Province), Nghi Loc, Can Loc (Ha Tinh Province).

(d) Vinh Phuc Formation, Luviomarine deposits ($amQ_{IIIv}p$): consist of black clay bearing peat, yellow spotted white grey clay, about 50 m thick.

(e) Marine deposits, luviomarine deposits, marsh deposits ($amQIV^2$, bm QIV^2, $mQIV^2$) developed in coastal areas from Thanh Hoa–Nghe An, consist of yellow grey clay, sand, 20–30 m thick.

(f) Fluvial deposits, luviomarine deposits, sea wind deposits with sand bank and marsh shape, long sandy soils running in parallel with coastline, some peaks of 7.0–8.0 m high.

(3) Quang Binh–Quang Tri

The route will mainly pass areas with coastal sandy soils, great thickness, sometimes inter-bedded with soft soil layers of <10.0 m thick; some route sections in Quang Tri, Hue will pass pre-Quaternary stone-forming ground.

(a) Long Dai Formation $O_3 – S_1$ld, includes 3 members:

- Member I: sandstone, quartzitic sandstone, siltstone, thin-bedded shale; 400–500 m thick;
- Member II: argillaceous limestone, limestone intercalated with silty sand; 400–500 m thick; and
- Member III: clay shale, ash-grey, grey siltstone; 300–400 m thick;

(b) Tan Lam Formation D_1tl includes 32 members:

- Member I: conglomerate, sandstone, red brown silty sand with some thin layers of limestone lenses, clay marl; 350–400 m thick; and
- Member II: red brown, yellow grey clay shale, interbedded with some layers of sandstone, siltstone; 300–400 m thick;

(c) Cam Lo Formation: P_2 cl includes 2 members:

- Member I: black grey, thin-bedded coaly shale, clay shale interbedded with some layers of small-grained sandstone, dark grey siltstone; 140 m thick; and
- Member II: dark grey, light green grey marlaceous shale; 60m thick;

(d) Tra Bong Complex d-gdO-S tb: described in the region as Xoa Village Complex, consist of quartz diorite, dark grey, yellow grey biotite granite;

(e) Aluvi-marine deposits ($mbQ_{IV}3$) consist of black grey clay with lots of faunal remains, white grey clay mixed with faunal remains, peat, fine sand, yellow clay.

(f) Fluvial deposits, luviomarine deposits, sea wind deposits: (mvQ_{IV}^3), (am Q_{IV}^3) with sand bank and marsh shape, ten kilometers long sandy soils in parallel with shore, some peaks of 5.0-25.0 m high.

(4) Quang Tri–Hue–Tuy Loan (Danang)

(a) From Quang Trị to Hai Van Pass Segment includes:

(i) Long Dai Formation $O_3 – S_1$ld, includes 3 members:

- Member I: sandstone, quartzitic sandstone, siltstone, thin-bedded shale; 400-500 m thick;
- Member II: argillaceous limestone, limestone intercalated with silty sand; 400-500 m thick; and
- Member III: clay shale, ash-grey, dark grey siltstone; 300-400 m thick;

(ii) Tan Lam Formation D1tl includes 32 members:

- Member I: conglomerate, sandstone, red brown silty sand with some thin layers of limestone lenses, clay marl, 350–400 m thick; and
- Member II: red brown, yellow grey clay shale, interbedded with some layers of sandstone, siltstone; 300–400 m thick;

(iii) Cam Lo Formation P_2 cl includes 2 members:

- Member I: black grey, thin-bedded coaly shale, clay shale interbedded with some layers of small-grained sandstone, dark grey siltstone; 140 m thick; and
- Member II: dark grey, light green grey marlaceous shale; 60m thick;

(iv) Tra Bong Complex d-gdO-S tb: described in the region as Xoa Village Complex, consist of quartz diorite, dark grey, yellow grey biotite Granite;

(v) Luviomarine deposits (amQ_{IV}^2) distributed along coastline from Le Thuy, Vinh Linh, and from Gio Linh, passing Trieu Phong to Hai Lang with northwest-southeast direction, largest part of 8 km wide; consist of sand, clayey silt with colors of yellow grey to black grey; 18–20 m thick;

(vi) Fluvial deposits, luviomarine deposits, sea wind deposits: (mvQ_{IV}^3), (amQ_{IV}^3) with sand bank and marsh shape, tens kilometer long sandy soils in parallel with shore, some peaks of 5.0–25.0 m high.

(vii) In separate Holocene Basalt Formation (bQ_{IV}): distributed in western Vinh Linh, western Gio Linh.

(b) From Hai Van to Tuy Loan Segment: the route will pass ground of Hai Van Formation; Hai Van Complex Granite.

(5) Quang Ngai–Phan Thiet

The route will mainly pass areas of coastal sandy soils, great thickness, soft soil layers only inter-bedded and filled up in depressions, usually <10.0 m thick; some route sections will pass deposits of pre-Quaternary period.

(a) Stone and soil of Arkei Formation, Kin Son Formation: biotit quartzitic shale, quartzitic shale, 1,950 m thick.

(b) Granite magma of An Khe Formation, Hai Van Formation, granite of Van Canh Complex, Deo Ca Complex, Dinh Quan Formation;

(c) Basalt of Nha Trang Formation;

(d) Aluvi-marine deposits (mbQ_{IV}^3) consist of black grey clay mixed with lots of faunal remains, white grey clay mixed with faunal remains, peat, the top including fine sand, yellow clay.

(e) Fluvial deposits, luviomarine deposits, sea wind deposits: (mbQ_{IV}^3), (amQ_{IV}^3) with sand bank and marsh shape, long sandy soils running in parallel with coastline, 4–5.0 m high, even 20–25.0 m high.

3) Hydrology

Characterized by tropical monsoon climate, Vietnam has two (2) main wind seasons every year: the Northeast monsoon wind in winter and Southwest monsoon wind in summer. The Southwest monsoon wind throwing through sea brings much humidity to land. Also, storms during summer often occur with tropical low pressure resulting to large scale heavy rains. On the average, Vietnam experiences 4–5 storms annually and a maximum of 12-13 storms hitting land areas or directly affecting the country. Storms and/or tropical low pressure may cause floods depending on the region's topography and river condition. In addition, the occurrence, characteristics and severity of floods vary from one region to another due to differences in topographical influence. A storm can cause higher sea level and bring more water into estuaries thereby flooding large plain areas. Rains caused by storms when rivers are at high flood peak can form big floods that threaten the system of dykes and dams, livelihood and the economy in general. These natural disasters are expected to become more appalling due to inappropriate and indiscriminate human activities. For example, plantations in mountainous areas contribute to increased erosion, alluvium and surface discharge leading to higher flood waters with earlier occurrence. As such, storms and floods are becoming the most dreadful natural disasters in Vietnam.

Plentiful surface water resources are one of the main reasons for the formation of 2,360 rivers and streams with at least 10 km long. Running along the 3,260 km coastline are 1,600 rivers with outlets into sea, which means an average of one estuary for every 20 km of coastline.

The system of rivers and streams in Vietnam has the following characteristics:

(i) High density;

(ii) Mostly northwest to southeast direction;

(iii) Some rivers integrate into one at their upstream side before running down to the plain;

(iv) Strong flow in mountainous area then slowing down before going into the sea; and,

(v) Distinguished seasons of flow are dry season and rainy one.

Vietnam's rainy season and flow condition are spatially distributed, as follows:

(i) In the North region, rainy season is from April to September, October;

(ii) In the Central region, rainy season is from August to December;

(iii) In the South Central region, rainy season is from September to December;

(iv) In the Central and South Central Highlands, rainy season is from May to October; and,

(v) In the South, rainy season is from April, May to October, November.

Accordingly, most regions in Vietnam have rainy season from April, May to October, November, except for the coastal Central region with its rainy season due to Annamite Range in combination with northeast circulation,

In general, the flood season is often one or two months shorter and occurs one month after the onset of the rainy season. The flow amount occupies up to 70÷80% of the total annual amount of rainfall during the flooding season, while it only occupies 20-30% of the total in dry season. On the other hand, rivers become narrower with high salinity due to decreases in flow speed and tidal influence during the dry season..

Sweeping floods occurring in small slope basins in the Central region and upstream areas of main rivers have caused terrible and serious material damage and human loss. The flood flow sometimes carries mud, stone and gravelly sand that can bury houses and infrastructure works.

In addition to climate factors, buffer factors (forest, soil), topography and human economic activities also contribute much to the flow formation of each region. Comprehensive studies on climate, hydrology and sustainability of works against natural impacts play an important role in the design and implementation of transport facility/network projects.

The hydrological characteristics of project-related areas are summarized as follows:

(1) Northern Plain

The Northern Plain region is located between the Northeast and Northwest mountainous areas, separated with Thanh Hoa plain area by a low and narrow hill range from Nho Quan to the sea.

Common features of rivers in the Northern Plain region include small and medium river speeds between 0.02–0.05 m/km and meandering flows. Over 1,500 dams were constructed along big rivers and several lakes, serving as basis for dividing the Northern Plain region into two types of river with two different hydrological conditions:

(i) Infield Rivers: all short, small-sized, and separated by dams, not related to hydrological condition of big rivers. Usually, these rivers are only connected to big rivers through small culverts in dams. The hydrological condition of such rivers is completely dependent on the rain condition of the region. During rainy season from May to October and at times during strong floods from big rivers, infield rivers cannot drain water and rain resulting in water clogging and flood.

(ii) Downstream of big rivers: “out-dammed” rivers are all big rivers, with small slope, complicated hydrological condition, capable of erosion together with strong filling. The flood season is usually from May to October although big floods do not completely coincide with heavy rains in the plain region. There are times of droughts in fields while there are floods out of dams and vice versa. Floods of out-dammed rivers are decided by rains in mountainous areas and are characterized for being high-level and long-lasting.

Big rivers in the Northern Plain region related to the North-South Expressway are mainly in the lower basin of Red River, including the main flow and some tributaries. The Red River is the biggest river in the Northern Plain region, with flood season occurring from May to October. Big floods in the Red River during the period 1945–1971 broke several dams and dykes and caused serious human and material damage in large areas of the region.

(2) Thanh Hoa–Nghe AN–Ha Tinh Region

Some major hydrological features of this region are as follows:

(i) Natural river system is quite dense with over 1 km/km^2, short, quite high slope; mobility and change of flow are popular;

(ii) Independent river systems, clear basins separated by mountain ranges running to sea;

The three (3) main river systems in this region are:

- System of rivers in Thanh Hoa Region including Ma River, Chu River, Hoat River, Yen River.
- System of rivers in Thanh–Nghe Region including rivers of Khe Dua, Hoang Mai, Do Ong and Bung.
- System of rivers in Nghe Tinh including rivers of Cua Lo, Ca, Nghen, Nhuong and Quyen.

(iii) Complicated hydrological condition in terms of flow variation and distribution. Annual flow amount decreases from Thanh Hoa to Nghe An, and increases in Ha Tinh;

(iv) Flood season in this region occurs from June to October in Thanh Hoa, from August to September in Nghe An and lasts until December in Ha Tinh. Floods are mainly formed from storming rains and lasts in a short time of 2–4 days;

(v) Big floods occurred in this region in 1927, 1934, 1950, 1960, 1978 and 1988; and

(vi) Regional rivers are also under tidal effects which result in flood drainage, typical example of which is Dien Chau. Aperture extension of bridges and culverts cannot totally handle the floods because the system of dams and dykes against salinization in downstream side also affects the drainage process.

(3) Quang Binh–Quang Tri–Thua Thien Hue Region

Most of the rivers and streams in this region start from the Annamite Range. Located along high and mountainous topography and coastal narrow delta strip, these rivers and streams are short, with high slope of river beds and great shape factor. Most of the rivers are sector-shaped, quick focused flood in tributaries; when running into estuary, flood is affected by tide leading to drainage. The regional river systems are as follows:

(a) **Gianh River:** Gianh River starts from Annamite Range, running north-to-south and passing mountainous slope area. To the plain of northern Quang Binh, it integrates with Trooc River and then flows out to sea in Thanh Khe. Generally, there is no dam for this river, but in the downstream side near the estuary is a small and low dam that is often flooded and overflows to the roads.

(b) **Kien Giang River:** this is closed topographical area. Two tributaries of Kien Giang and Dai Giang from Annamite Range suddenly become wider in the plain area. This river does not flow straight toward sea due to high sandy soils, which changes the river flow in parallel with the coastline, and then go into the sea through the Nhat Le estuary. Likewise, because of sandy soils and the dry estuary of Nhat Le, water is difficult to drain and rises up to flood the current NH1 for ten kilometers.

(c) **Thach Han River and Huong River System:** narrow delta, some sections at 10km wide, with a number of large lagoons (the largest is Tam Giang lagoon). White sandy soils along coastline gradually get nearer to land. Rivers and streams with meandering directions flow along sandy soils then difficultly flow out to sea. Fast focused flood,

passing through curved river sections, is influenced by tide. In Hue City, floods often overflowed the streets up to 2 m.

Flood season is from August to December. Big floods of this region occurred in 1950, 1964, 1971, 1980, 1981, 1983, 1985, 1999 and 2000.

(4) Central Region

This region starts from the Hai Van Pass to Binh Thuan Province, with flood season from October to December. Floods occur about one month after the start of rainy season in regional big rivers of Thu Bon River and Ba River.

(a) Thu Bon River

Thu Bon, Cai and Bung Rivers are mainly southwest-to-northeast slope. On average, the river density is 0.40 km/km^2. Rain fall in this region is less than 2,000 mm/year.

The main flow of Thu Bon River starts from the Ngoc Linh Mountain area and into sea in Hoi An. Before going into the sea, its main flow is the Vu Gia River (formed by Cai River and Bung River). In the lower section of the river with NH 1A, it develops into interlacing, complex network with many different distributaries to sea, such as the Ngang River, Vinh Dien River and Tinh Yen River into Danang Bay, and through Han River and Truong River into An Hoa Bay.

The flood season often happens coincident in this region. Flow amount in flood season accounts for 65% of the annual total flow, with the highest flow amount in October or November accounting for 25-35% of the total. Variation between the highest and lowest flow may reach up to 700 times. Coincident floods terribly threaten the Quang Nam–Danang Delta, flooding many sections of NH1. The historic flood in 1964 was the biggest one reaching even the railway level.

(b) Ba River (Da Rang)

In general, this river receives little rainfall amount for it is located in an area sheltered from wind and is characterized by poorly-developed system of rivers and streams. The average rainfall amount of this basin is 1,625 mm and the average density of rivers and streams is around 0.30-0.40 km/km^2.

Flood season in the lower section of the river is from September to December due to heavy rains caused by northeast monsoon that often occurs in early December. Floods of Ba River are so dangerous for the middle stream and downstream areas when there are heavy rains in the whole river. Flow in flood season accounts for 69–73% of the total annual flow discharge. The maximum flood flow occurs in November, accounting for 21–41% of the total. The highest flood level of Ba River is usually up to Warning Level 3 or higher. The double flood formed in Ba River from the 9th to 20th November 1981 caused serious damage in the provinces of Phu Yen and Khanh Hoa. Despite not having much water compared with the other big rivers in the South, floods in the downstream of Ba River are so severe that it is very critical to construct irrigation works in upstream areas to ensure safety for the downstream.

3.3 Socio-economic Characteristics

As shown in Table 3.3.1, the total population in the direct influence area of the North-South Coastal Corridor is around 48 million as of 2008, accounting for about 56% of the national total. This regional population is projected to grow to 65 million (or 57% of the total) in 2030. The average gross regional domestic product (GRDP) growth rate in the past seven (7) years is 9%, which is slightly higher than the national average (see Figure 3.3.1). The major features that characterize this corridor are the rapidly growing urbanization ratio and the high GRDP per capita. The corridor is the economic spine of Vietnam and is indispensable for national growth, and its dominance over the entire country is expected to increase furthermore.

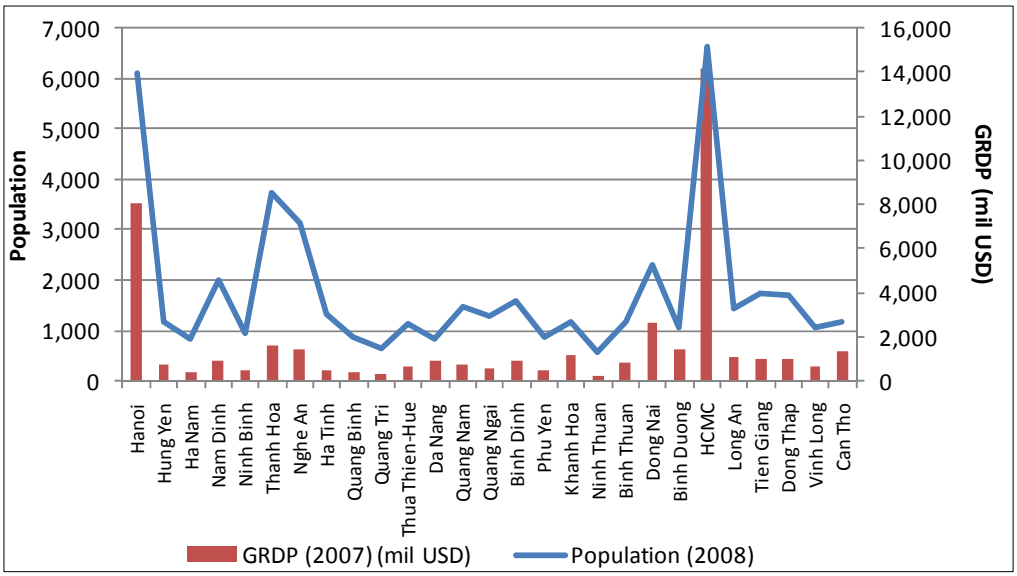
The Southeast region, encompassing HCMC, Dong Nai and Ba Ria–Vung Tau, produces 46.6% of the national industrial output, since a high portion of foreign-invested enterprises are located the region. The second largest industrial region is Red River Delta with a 25% share of the national industrial gross output. These areas are directly served by the North-South Expressway. Figure 3.3.2 shows the industrial parks established in the country, with most of the parks located along the North-South Expressway.

Table 3.3.1 Socio-economic Profile of Provinces located along the North-South Expressway (Coastal)

Province	Area (km^2)[1)]	Population (000)			Urban Population Rate (2008) (%)	GRDP (2007) (mil USD)[2)]	Per Capita GRDP (2007) (USD)	Poverty Rate (2006) (%)	FDI (1988-2008) (mil USD)[3)]
		2000	2008	Growth (%/year)					
Hanoi	3,349	2,739	6,116	2.2	42.0	6,697	2,036	3.0	20,228
Ha Tay	-	2,414	-	-	-	1,329	519	12.4	-
Hung Yen	923	1,081	1,167	1.0	11.2	734	635	11.5	729
Ha Nam	860	796	834	0.6	10.0	385	467	12.8	203
Nam Dinh	1,652	1,904	1,990	0.6	16.9	908	456	12.0	120
Ninh Binh	1,389	890	936	0.6	16.9	460	495	14.3	535
Thanh Hoa	11,135	3,494	3,713	0.8	10.0	1,597	432	27.5	6,993
Nghe An	16,499	2,887	3,131	1.0	12.3	1,474	475	26.0	335
Ha Tinh	6,026	1,275	1,307	0.3	13.1	471	365	31.5	7,941
Quang Binh	8,065	802	858	0.9	14.5	411	481	26.5	35
Quang Tri	4,744	581	636	1.1	24.6	305	487	28.5	68
Thua Thien-Hue	5,065	1,064	1,151	1.0	31.8	641	557	16.4	1,900
Da Nang	1,283	704	818	1.9	86.9	939	1,166	4.0	3,080
Quang Nam	10,438	1,389	1,492	0.9	17.5	785	529	22.8	767
Quang Ngai	5,153	1,200	1,303	1.0	14.7	615	477	22.5	4,652
Binh Dinh	6,040	1,481	1,593	0.9	26.6	911	577	16.0	253
Phu Yen	5,061	801	886	1.3	20.3	460	522	18.5	6,315
Khanh Hoa	5,218	1,051	1,162	1.3	40.7	1,149	1,002	11.0	817
Ninh Thuan	3,358	515	583	1.6	32.3	227	395	22.3	9,953
Binh Thuan	7,810	1,066	1,189	1.4	40.0	802	685	11.0	778
Dong Nai	5,903	2,039	2,290	1.5	31.5	2,657	1,179	5.0	14,753
Binh Duong	2,695	738	1,072	4.8	31.1	1,406	1,375	0.5	9,984
HCMC	2,096	5,226	6,612	3.0	85.2	14,179	2,234	0.5	29,246
Long An	4,494	1,330	1,439	1.0	17	1,049	733	8.7	2,896
Tien Giang	2,484	1,623	1,742	0.9	15	1,036	600	13.2	295
Dong Thap	3,375	1,578	1,683	0.8	17	966	578	12.1	44
Vinh Long	1,479	1,018	1,069	0.6	15	702	661	11.0	57
Can Tho	1,402	1,836	1,171	-5.5	52	1,310	1,134	7.5	799

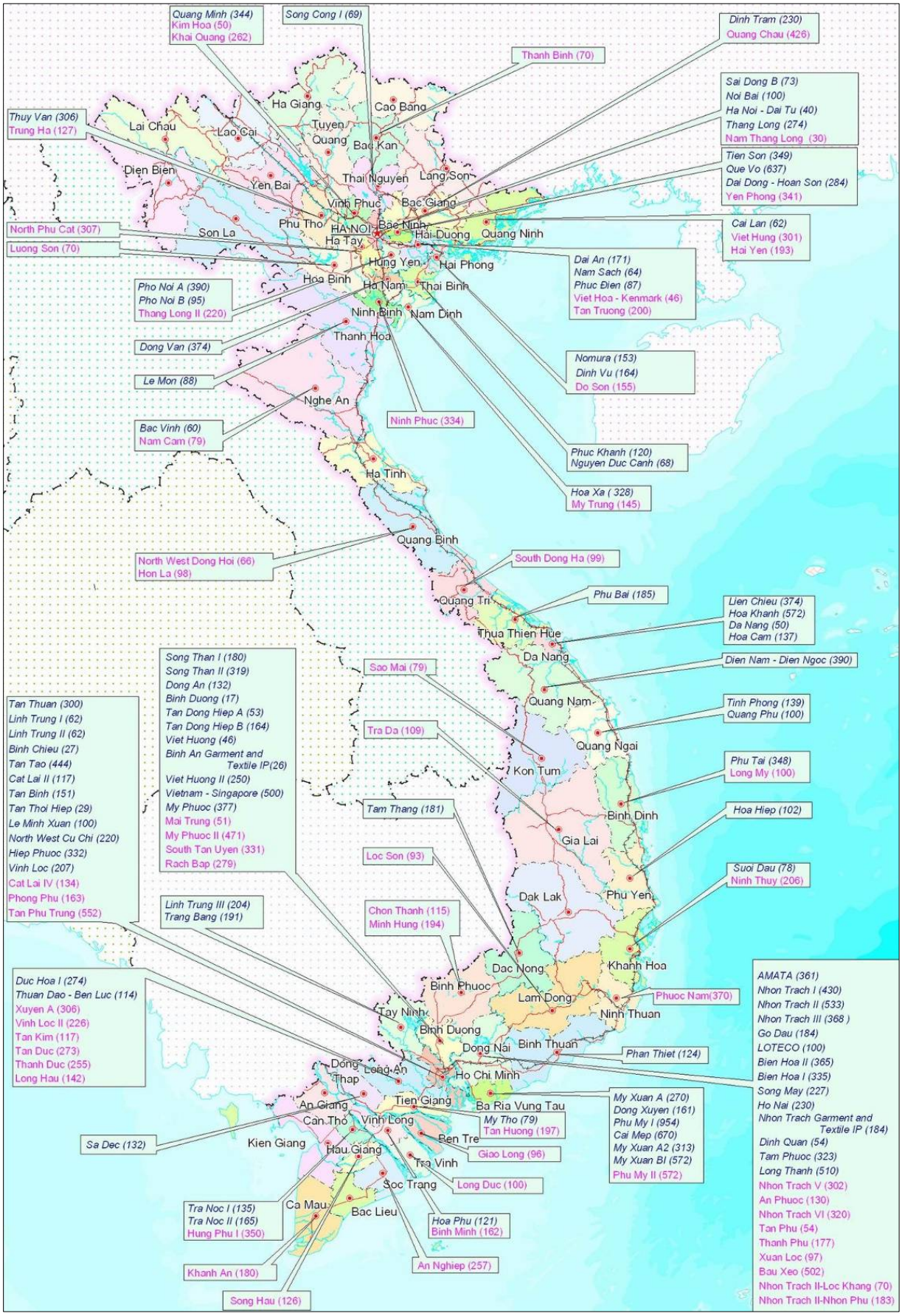
Source: General Statistic Office
Note:
[1)] According to new administrative border as of January, 2010, [2)] at current 2007 price, [3)] at constant 1994 price.

Figure 3.3.1 Socio-economic Profile of Provinces located along the North-South Expressway (Coastal)



Source: General Statistic Office

Figure 3.3.2 Established Industrial Parks



Source: Department of Industrial Zone Management, MPI, 2006

3.4 Transportation Demand

The North-South Coastal Corridor involves all the transport modes available in Vietnam although the inland waterway plays only a marginal role on both ends of the corridor. The NH1 runs the entire stretch of the corridor together with the north-south railway. These two transportation infrastructures are the visible backbone of the country. There are also a number of ports and airports located at every major city in the corridor which play an important role in carrying passengers and freight from one city to the other areas in the corridor.

1) Current Transport Demand

The transportation network in the corridor is highly congested (See Figure 3.4.2). The daily cross-sectional traffic of all modes at present varies between 39 and 65 thousand passengers and between 59 and 98 thousand tons of freight. The passenger traffic is particularly heavy near Hanoi, Da Nang and HCMC, while freight traffic is significant in the north and central sections of the corridor.

At present, passenger traffic is largely shouldered by buses while the share of rail and air transportation is not yet significant. The modal share in freight traffic is large for shipping (particularly for long-distance) and road (truck) transportation, while the share of railway is insignificant.

2) Demand Characteristics and Demand-Supply Gap

By 2030, transport demand along this corridor is expected to increase remarkably. Cross-sectional traffic is forecasted to increase roughly 5–8 times for passenger and 3–5 times for freight.

For road, the demand is projected to exceed the capacity throughout the corridor, thus the need to at least double the road capacity in both the north and south sections of the corridor.

The increase in air transport demand is also outstanding. If rail and road transportation are not improved in the future, the existing major airports will all be saturated.

Another critical factor is the freight-carrying capacity of existing railway as the freight transport demand for this mode is so strong due to its route alignment and low cost. (see Figure 3.4.2)

Table 3.4.1 National Transport Demand Characteristics

Passenger Traffic Demand in 2008

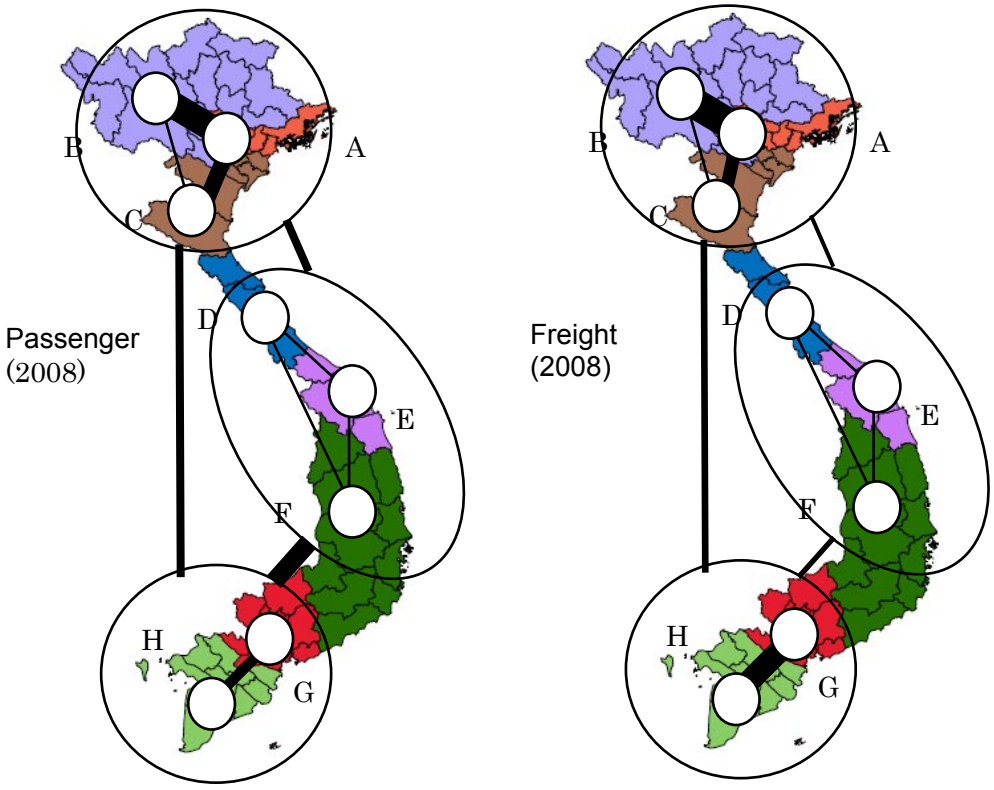
		North			Central			South	
		A(NFEZ)	B	C	D	E	F	G(SFEZ)	H
North	A(NFEZ)	246,843	103,613	58,932	2,754	4,341	3,980	15,786	1,408
	B		4,660	9,338	480	187	2,126	2,843	305
	C			5,251	10,900	2,059	2,958	10,748	279
Central	D				1,099	5,394	610	1,968	294
	E					19,199	7,919	8,642	100
	F						18,194	41,083	13,984
South	G(SFEZ)							265,739	43,158
	H								67,447

Freight Traffic Demand in 2008

		North			Central			South	
		A(NFEZ)	B	C	D	E	F	G(SFEZ)	H
North	A(NFEZ)	309,521	232,207	104,705	1,627	6,895	9,687	35,538	4,412
	B		6,659	17,852	840	719	1,617	1,989	84
	C			33,311	4,332	2,760	3,470	5,974	607
Central	D				431	1,251	265	1,200	214
	E					11,823	4,322	9,509	397
	F						3,946	26,923	208
South	G(SFEZ)							229,627	171,976
	H								84,831

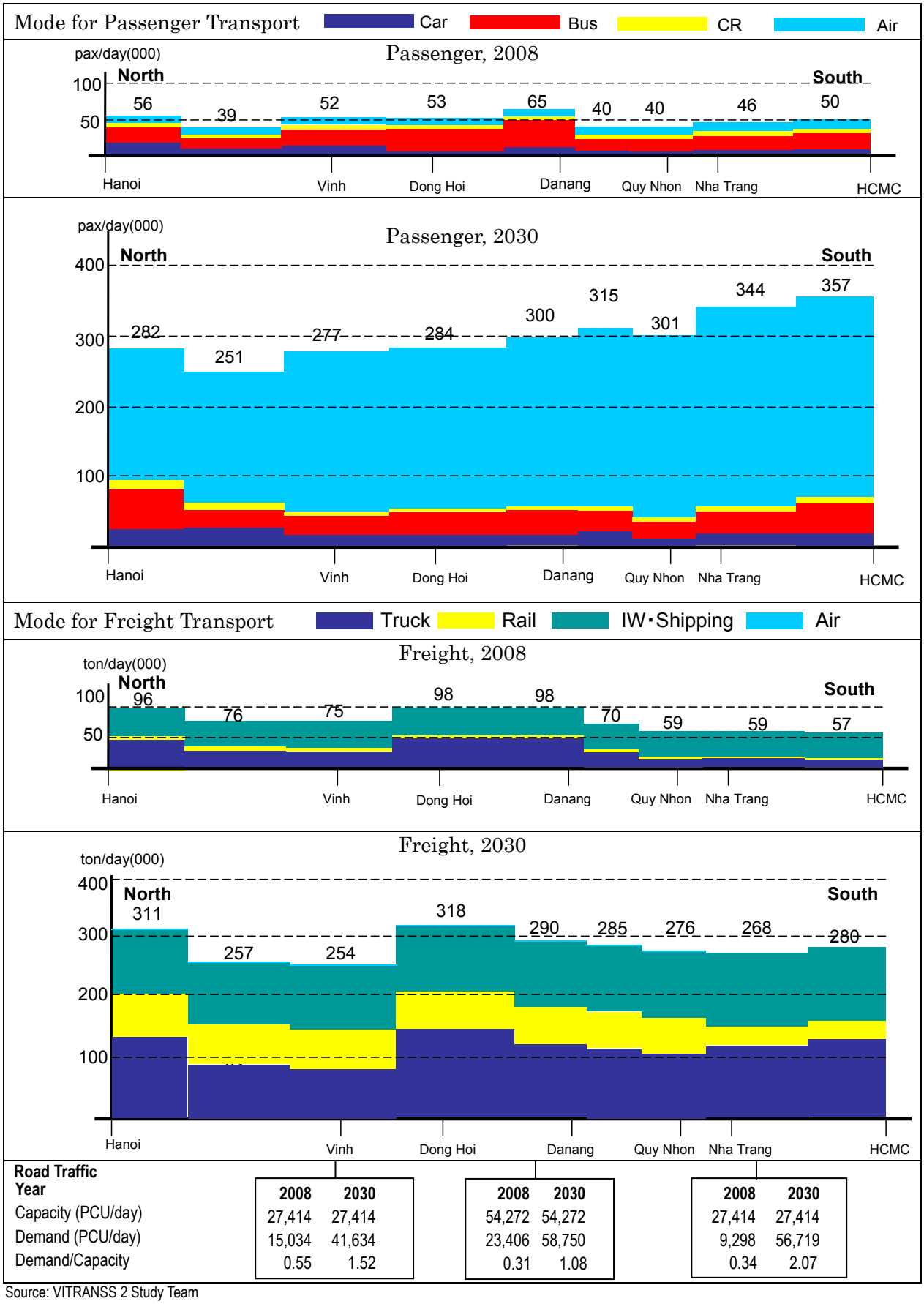
Source: VITRANSS 2 Study Team

Figure 3.4.1 National Transport Demand Characteristics



Source: VITRANSS 2 Study Team

Figure 3.4.2 Present and Future Transport Demand and Demand-Supply Gap - North-South Coastal Corridor



Road Traffic Year	2008	2030	2008	2030	2008	2030
Capacity (PCU/day)	27,414	27,414	54,272	54,272	27,414	27,414
Demand (PCU/day)	15,034	41,634	23,406	58,750	9,298	56,719
Demand/Capacity	0.55	1.52	0.31	1.08	0.34	2.07

Source: VITRANSS 2 Study Team

3.5 Transportation Network Connectivity for Regional Integration

The road (NH1) is mostly of two (2) lanes with 4-lane short sections near large cities. The pavement is relatively well-maintained. However, some bridges (e.g., in Quang Ngai and Khanh Hoa) are in poor condition. Moreover, the current road structure is weak and should be strengthened to accommodate heavy vehicles that would increase along with the promotion of the containerization.

The capacity of rail transport is limited mainly due to its design standard and age. The railway is of single track and the traction system is for diesel-driven locomotives. Although the tracks are relatively well-maintained, numerous obsolete bridges and limited-speed sections (up to 15 km/h in this corridor) need rehabilitation or reconstruction.

There are several airports in this corridor as shown in Table 3.5.1. The Tan Son Nhat Airport in HCMC is proposed to be relocated to Long Thanh by 2015 to handle the increasing demand despite having the largest passenger handling capacity in Vietnam. The Noi Bai Airport in Hanoi is already saturated but has a room for further expansion, with a new terminal construction already committed. The Da Nang Airport, with the ongoing construction of a new terminal building, will have no capacity issue. However, the airport does not satisfy the ICAO technical recommendation in relation to the distance between runway and taxiway and the width of runway strip.

In this corridor, many ports are located to serve coastal and ocean-going shipping as shown in Table 3.5.1. Among major ports, Hai Phong has a design depth of 7.3 m. However, it becomes 4–5 m before periodic dredging and vessels have to wait for high tides to enter/leave the port. Its handling capacity has been almost reached due to rapidly increasing demand particularly for containers. Quang Ninh (Cai Lan) faces difficulty in expanding its capacity because of the environmental restrictions required in the Ha Long Bay protection area. Da Nang and Binh Dinh (Quy Nhon) ports need capacity expansion to cope with the rapidly growing demand. The ports in HCMC have also capacity issues, and vessels have to go up the river for about 80 km. This is due to the shallowness of the channel at about 8m, such that large ships serving the trunk shipping routes cannot directly approach the port despite the magnitude of demand.

Table 3.5.1 Transport Infrastructure of the North-South Coastal Corridor

	Location		Hanoi–Vinh (NH1, 365 km)	Vinh-DaNang (NH1, 650 km)	Da Nang–Nha Trang (NH1, 510 km)	Nha Trang-HCMC (NH1, 350 km)
ROAD	Width		4 Lane:15% 2 Lane: 85%	4 Lane:12% 2 Lane: 88%	4 Lane:5% 2 Lane: 95%	4 Lane:20% 2 Lane: 80%
	Surface Condition		Good: 50% Fair: 18% Bad: 32%	Good: 37% Fair: 63%	Good: 85% Fair: 8% Bad: 7%	Good: 14% Fair: 68% Bad: 18%
	Bridges	No	56	175	264	94
		Length (m)	3,810	10,135	18,585	3,407
RAIL	Track		Meter gauge (Single Track)			
	Location		Hanoi-Vinh	Vinh-DaNang	Da Nang–Nha Trang	Nha Trang -HCMC
	Crossings (no)		294	272	269	238
	Bridges	No	127	270	487	267
		Length (m)	3,390	11,298	14,588	5,667

	Location		Hanoi (Noi Bai)	Vinh (Nghe An)	Quang Binh (Dong Hoi)	Hue (Phu Bai)	Da Nang (DaNang)	Quang Nam (Chu Lai)	Binh Dinh (Phu Cat)	Phu Yen (Dong Tac)	Khanh Hoa (Cam Ranh)	HCMC (Tan Son Nhat)
AIRPORT	Service		Int'l/ Domst	Domst	Domst	Domst	Int'l/ Domst	Domst	Domst	Domst	Domst	Int'l/ Domst
	Runway (m)		3,800	2,400	2,400	2,700	3,048	3,658	3,048	2,743	3,048	3,800
	Capacity	Pax (000/yr)	6,000	100	300	582	1,000	291	291	20	243	15,000
		Cargo (ton/yr)	150,000	-	-		-	-	-	-	-	150,000

	Location		Quang Ngai	Hai Phong	Thanh Hoa	Nghe An	Ha Tinh	TT Hue	Da Nang	Quang Ngai	Binh Dinh	Khanh Hoa	BR-VT	Dong Nai	HCMC
PORT	Class 1 Seaport		Cam Pha, Hon Gai	Hai Phong	Nghi Son	Cua Lo	Vung Ang	Chan May	Da Nang	Dung Quat	Quy Nhon	Nha Trang, Ba Ngoi	Vung Tau	Dong Nai	Ho Chi Minh
	Service		Int'l/ Domst	Int'l/ Domst	Int'l	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst	Int'l/ Domst
	Berth	No.	12	51	6	9	4	7	20	3	8	6	34	22	82
		Length (m)	2240	5513	2292	836	304	780	2249	170	1120	749	5348	2791	9068
	Depth (m)		-12	-8.7	-10	-7.5	-10.8	-12.5	-12	-9.5	-12	-11.8	-12	-9.5	-13
	Capacity (000 ton/yr)		5,115	9,712	0	786	501	287	2,044	29	1,669	2,572	1,623	790	12,422

Source: VITRANSS 2 Study Team